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## Speaking of Microphones

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Probably, all of us use one sort of military issue carbon microphone or another with vintage military equipment. I'd like to present some information on the various types available and perhaps some insights in keeping these devices in operational condition. This article will address what I believe are some of the most popular carbon mics currently used on our military ground-based equipment and include some information I've been able to accumulate on them, to include a bit of contemporary information, too.

One of the earliest mics that appear to be commonly used is the T-32 candlestick mic. The T-32 uses a conventional

low-impedance<sup>1</sup>, single-button element similar to the common telephone F1 unit, although a much earlier design. The T-32 is actually a modification of a '20s or '30s desk telephone, sans receiver. What they did was chop off the movable hang-up fork—leaving a small thumb-lever—and use the existing off-hook linkage and switch contacts mounted in the base for the PTT. This mic can have outstanding output and sound quite good, assuming the element is still active. A more modern telephone element can be substituted if replacement is required.

Next on the list, and perhaps the most prolific of the era, is the venerable T-17. The T-17 is also a low-impedance, single-button carbon mic. Variations of the T-17 are lettered units up to and including the T-17D. The T-17 microphone, with its characteristic SW-109 PTT switch



(often erroneously cited as the model number) is a good microphone, when you find a working example. Many non-functioning T-17s can be resurrected with excellent results. But, I will have more on the T-17 later.

Of the same relative vintage as the T-17 is a Navy-designed mic, generally the nomenclature is a Type 9044 or NAF21364. Many of us know this round-shaped mic as the RS-38. The RS-38 series can still be seen in aircraft installations, often as a transistorized, carbon-compatible unit. I have found all too many of my vintage RS-38 type mics to be of very low output and of poor quality audio. Even the newer one in my Piper Cherokee was replaced. The RS-38 type mic can be overhauled.

Next in the series of mics is the M-15/UR. The M-15/UR is the noise-canceling replacement for the T-17-series mics. It looks about the same but has a characteristic extended snout that accommodates the noise-canceling ports. Like the T-17, the M-15/UR can be overhauled. Note, at this juncture, that all preceding microphones utilize the military standard, 3/8-inch, 3-circuit, PL-68 or PJ-068 plug.

Another vintage mic, albeit a bit more contemporary, is the M-52() hand mic. This mic is, in reality, a ground version of an aviation microphone, mounted on a PTT hand-grip. This mic utilizes the snap-in, replaceable, M-51/UR element. Similar to the M-51/UR element is the WWII T-45 lip mic. The T-45 may well be the direct predecessor to the M-51 mic element. The M-52() and its variants can be found with either the PL-68 or the newer U-77 connector plug. We'll discuss the U-77, below.

The last vintage carbon mic to be directly addressed is the H-33/PT. This unit is a handset, rather than simply a microphone. The H-33/PT was introduced about the time of the Korean conflict and was used with what's generally accepted as "Old Family" signal

equipment. Unlike earlier military mics, the H-33/PT uses the combination transmitter and receiver audio plug, U-77. The U-77 is compatible with many foreign radio sets—by plan and design.

The H-33/PT can be an outstanding carbon mic if the element is in good condition and, if necessary, can be successfully rejuvenated.

The mics mentioned above in this article are by no means a complete list. There were a myriad of WWII and Korean conflict and later telephone-style handsets that are both usable and fully repairable, more often than not via direct replacement with modern telephone elements. It's for this reason I didn't mention them, in detail.

With new designs in military communications equipment in the late 1950s, audio requirements moved away from carbon microphones. The old carbon mic input circuit was replaced by those requiring a low impedance<sup>2</sup>, dynamic microphone element. Dynamic elements are said to be of better audio quality and not as subject to some environmental extremes. About the time that the dynamic mic was introduced<sup>3</sup>, en-masse, the audio "connectorization" of military ground-based communications equipment also changed. The "Old Family" U-77 was replaced by the smaller "New Family" U-223, and its variants. As a point of possible interest, to date, military and civil airborne equipment have generally maintained the carbon or carbon-compatible design for avionics equipment<sup>4</sup>. To accommodate the new dynamic microphone elements installed in flight helmets, hand mics, and combination headset/microphones, the military adopted carbon-conversion modules and adaptors such as the MX-1646, et al. The same conversion technique is still use in civil and military aviation. Yet another even more contemporary change in military ground-based equipment is the Army's armor and vehicle integrated audio system

(VIC-1, LVCS, etc.). This system incorporates compatible dynamic mics, but "connectorization" is somewhat unique and is evolving. Discussion of this equipment is outside the scope of this article, beyond informing the reader that although the connectors appear to be standard "New Family," the individual pin assignment is not always identical, inasmuch as these systems accommodate both radio communications and the associated vehicle's onboard intercom system.

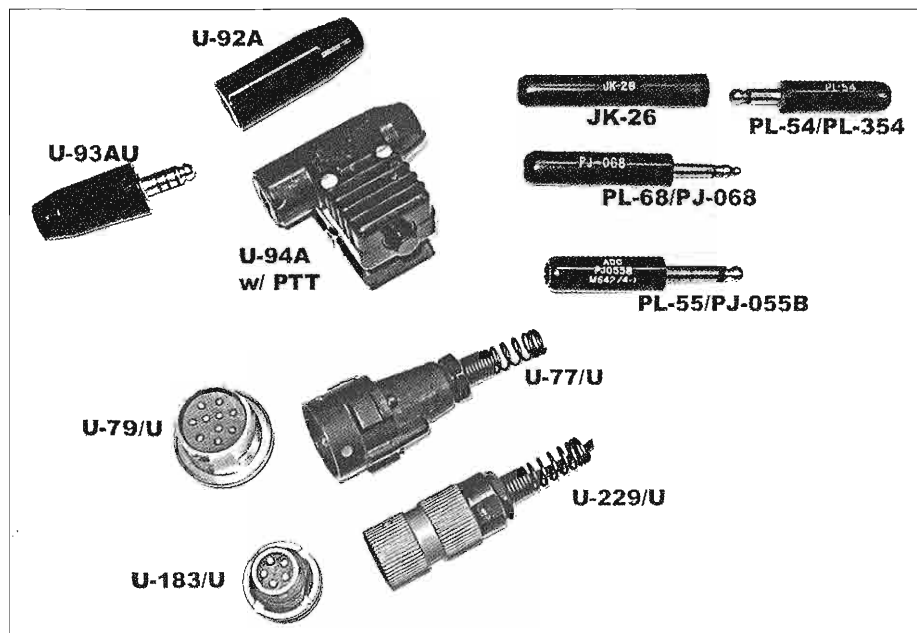
Regarding the care and feeding of vintage carbon mics, I offer the following observations and recommendations: While the old tried-and-true (?) method of beating the "bejesus" out of a carbon mic against wooden desk can sometimes produce short-term results, I recommend that attention be directed to the mic element, the bypass capacitor, and the PTT switch.

Beginning with the T-17s, the versions easiest to work on are the original, metal-case T-17 and the plastic T-17B. These mics can be successfully opened and re-

paired. The most difficult of the series is last of the litter, the plastic T-17D. While previous versions had a replaceable element, the T-17D does not. The T-17D element is integral to the front half of the mic itself. When disassembling the T-17D, the carbon granules will spill out as the element back cover is removed. There's no way to avoid this if the mic is to be repaired. I have tried to repack these elements but have had no success, whatever.

There are two methods of opening up a T-17-series microphone, depending on version. Earlier T-17s used a split-shell housing. Removal of the three screws on the back of the shell will reveal the rear of the microphone element. The bypass capacitor can be easily snipped out and replaced, if desired. I have yet to find a genuinely good capacitor in an old T-17!

If the mic in question is not of the split-shell type, the front of the mic can be opened up by carefully digging out the potting compound around the three mounting screws and then removing them. After cracking the case, there will



be sufficient service loop on the wires to be able to access the bypass capacitor. Some of the potting compound is said to be very tough, but I have always been able to dig the stuff out one way or another. Changing or removing an errant bypass capacitor is fairly easy to do and this alone may restore your mic to service!

To gain access to the contacts on the SW-109 switch, remove the two set screws on the side of the knob, remove the knob, and then the single screw holding the switch. You'll also have to loosen the mic cable to get enough slack to get to the contacts, however. If the capacitor and switch renewal don't complete the repair, the element is probably defective and there's more to be done.

Element replacement in T-17s is problematic, at best. T-17 elements, per se, are not available, to my knowledge. Although the selection of replacement elements is not manifold, what I have been able to successfully do is to either use the microphone element from an H-33/PT (at last check, still available from Fair Radio) or, better still, if you can find a good element from one of those clear plastic 1950s-vintage telephone operator's boom mics. Both of these elements can be successfully fitted to either a T-17 or a Navy RS-38-style microphone. Please note, however, that in most cases it will be necessary to route out a portion of plastic material from the front piece of the microphone to get the element sufficiently close to the voice holes and to allow closure of the case. This is particularly applicable to the T-17D and some RS-38s, where considerable material will need to be removed. The nice thing is, though, when you're done, it's all covered up inside the mic and externally, everything's original!

Have you ever seen a T-17 where someone has glued a telephone element to the front of a T-17 to get it going? I have, and although it certainly is functional, it looks

positively hokey—something akin to a pig wearing a gas mask.

Repair of microphones utilizing a snap-in M-51-type element consists of finding either another similar hand mic that one can cannibalize or finding an old, defunct Air Force HS-33 type headset that has an M-51 boom-type mic assembly attached to it.

Overhaul of the H-33/PT is currently a simple matter of procuring a replacement element from Fair Radio. Simply unscrew the end caps and remove and replace the element. Again, if you can locate one, the telephone operator's mic element would be an excellent alternative.

Whichever mic you're working on, remember to clean and burnish the PTT switch contacts. I've seen some otherwise nice mics with severely corroded switches.

Regarding mic cord replacement, if the cord is still in good condition for the major portion of its length, one can simply cut back and reattach. Beware, however, that some vintage mic cords use tinsel wire and you'll have a job reattaching (read: soldering) it. If you take the time, the small cupped crimp lugs used on most of these mics can be cleaned, reformed and used to reattach the cord. If the wire is of the tinsel type, each lug will have a spur that punches through the insulation, making contact. If you have reclaimed the crimp lug, you don't have to remove the insulation or tin the wire, simply carefully re-crimp it. If the cord is a total loss, I have found that light-duty, 3-conductor computer power cords make a very good sources of mic cable. Pick one that is very pliable and that does not have the extra cloth weave, shield, nor drain wire installed, just the three conductors. Although not as flexible as the original, they look "stock" and work well. Also, I have on occasion bought 3-conductor military microphone extension cables to repair several mics. I also buy similar 2-conductor cables to

make up headset extension cords. Fair Radio usually has something that will work. Beware, though, although NIB, these cables must be inspected. Finally, military mics have either a wrapped string or a circular brass clamp used to secure the cord to the PL-68 plug. As with the lugs, these brass clamps can be reclaimed for use. Some H-33/PTs came with a heavy-duty, coiled cord. Replacement can be accomplished using one of the computer-type power cords that, in this case, does have the additional drain wire. These cords are not coiled, however. If a coiled cord is considered a requirement, Belden offers several coiled communications cords. Use the U-77 pin connections outline in the Appendix.

Regarding the use of the more modern military dynamic mics, be advised they can be used on most amateur equipment via a miniature matching transformer. Earlier USAF boom mics were low impedance so an 8 ohm to high (5k) or medium (500 ohms) audio would suffice. Later USAF and Army aircraft and Army ground-based boom mics and handsets were of a higher impedance and a nominal 75 to 100-ohm input impedance is required. This includes H-250-series handsets, the Integrated Vehicle Communications headsets, etc. You'll just need to do a bit of testing and buzz out the wiring. Also, unless it's absolutely necessary, use the existing connectors on the equipment! The type of wire used on some of these units can be very difficult to work with and to solder. The required mating connectors are available from numerous sources, including Fair Radio<sup>5</sup> and the Wm. Perry Company<sup>6</sup>.

#### Footnotes:

1. Nominal 50 ohms
2. Nominal 4-10 ohms, later units are 75-100 ohms.
3. Note that dynamic mics were available and could have been used on WWII and later equipment such as the BC-614 speech amplifier (BC-610), the T-47/ART-13 transmitter, and much Army PA

equipment.

4. Military fixed-and rotary-wing aircraft and most civil rotary-wing aircraft utilize the NATO U-92-series, 4-pin connectors (see appendix).

5. Fair Radio Sales, 2395 St. Johns Rd., Lima, Ohio, 419-223-2196

6. Wm. Perry Co., 702(R) Beechwood Rd., Louisville, KY, 502-893-9220

#### Appendix:

Pin Assignments of various military audio connectors (see photo p.24):

- PL-55, PJ-055B 2-circuit, ¼", headphone plug: Tip = Audio Out (white or green), Sleeve = Ground, (black).

- PL-54, PJ054B, PL-354, 2-circuit, ¼" headphone short-cord plug (same as PL-55, above)

- JK-26 2-circuit headphone extension cord (mates with PL-54) (same as PL-55)

- PL-68, PJ-068 3-circuit, 3/8", microphone plug, referred to as a Drake or Collins plug (sic), Tip: PTT (white or green), Ring: Mic (red), Sleeve: Ground (black)

- U-77( ) Unified audio connector (Old Family)

A Audio Out

B Ground

C Mic

E Ground

F PTT

H Ground

K Carrier Control

- U-223( ) Unified audio connector (New Family)

A Ground

B Audio Out

C PTT

D Mic

E N.C. (or special purpose)

- U-92( ) Unified Audio Connector, NATO, Avionic (also referred to as a helicopter plug)

- U-92 Plug, U-93 Jack

Tip 1: Mic Hi

Ring 1, 2: Phones Hi

Ring 2, 3: Mic Lo

Sleeve 4: Phones Lo

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